4.2.4.9 Public and Occupational Health and Safety

The assessments of potential radiological and chemical impacts associated with the storage alternatives at Pantex are presented in this section. Summaries of radiological impacts from normal operations are presented in Tables 4.2.4.9–1 and 4.2.4.9–2 for the public and workers, respectively. Impacts from the hazardous chemicals are presented in Table 4.2.4.9–3. Summaries of impacts associated with postulated accidents are given in Tables 4.2.4.9–4 through 4.2.4.9–8. Detailed results are presented in Appendix M.

Aircraft Crash. Pantex is located approximately 13.6 km (8.5 mi) from the northeast-southwest runway at Amarillo International Airport. Potential accident scenarios in which an aircraft crashes into one or more facilities at Pantex have been developed for the Pantex EIS. A discussion of aircraft crash accident for this PEIS is contained in Appendix R.

No Action Alternative

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from normal operations involved with the Pantex site-wide missions, including storage of Pu. The impacts would be within applicable regulatory limits. For facility accidents, the risks and consequences are described in site safety documentation.

Normal Operation. The current mission at Pantex, where Pu is in interim storage, is described in Section 3.5. The site has identified those facilities that will continue to operate under the No Action Alternative, including Pu storage facilities and others, if any, that will become operational by 2005. Based on that information, the radiological and chemical releases to the environment in 2005 and beyond (future operation) were developed and used in the impact assessments. The resulting doses and potential health effects to the public and workers at Pantex are described below.

Radiological Impacts. The calculated annual dose to the average and maximally exposed members of the public from total site operation; the associated fatal cancer risks to these individuals from 50 years of operation; the dose to the population within 80 km (50 mi) from total site operation in the year 2030; and the projected number of fatal cancers in this population from 50 years of operation are presented in Table 4.2.4.9–1 under this alternative at Pantex. The annual dose of 6.1×10^{-5} mrem to the MEI is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.5×10^{-9}. The annual dose of 2.8×10^{-4} person-rem to the population would be within the limit in proposed 10 CFR 834. The corresponding number of fatal cancers in this population from 50 years of operation would be 7.0×10^{-6}. To put operational dose impacts into perspective, comparisons with doses from natural background radiation are included in the table.

Under the No Action Alternative, as shown in Table 4.2.4.9–2, the annual average dose to a non-involved (No Action) site worker and the annual dose to the non-involved (No Action) total site workforce would be 10 mrem and 14 person-rem, respectively. The associated risk of fatal cancer to the average worker from 50 years of total site operations would be 2.0×10^{-4}, and the projected number of fatal cancers among all workers from 50 years of total site operations would be 0.28. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public resulting from the normal operation under this alternative at Pantex are presented in Table 4.2.4.9–3. The hazardous chemical impacts from current site operations were used to estimate the baseline site impacts for the various storage alternatives. The noncancer health effects expected and the risk of cancer due to the total chemical exposures were estimated for each site. Since the major releases due to normal operations at Pantex are expected to make up nearly all of the exposures

Table 4.2.4.9–2. Potential Radiological Impacts to Workers During Normal Operation at Pantex Plant—Storage Alternatives

Receptor	Upgrade[a] With RFETS Pits	Upgrade[a] Without RFETS or LANL Pu	Upgrade[a] With RFETS and LANL Pu	Consolidation[a] New and Modify Zone 12 South	Consolidation[a] New Facility	Collocation[a] New Facility
Involved Workforce[b]						
Average worker dose (mrem/yr)[c]	116	116	116	254	258	264
50-year risk of fatal cancer	$2.3x10^{-3}$	$2.3x10^{-3}$	$2.3x10^{-3}$	$5.1x10^{-3}$	$5.2x10^{-3}$	$5.3x10^{-3}$
Total dose (person-rem/yr)	3	3	6	31	24	25
50-year fatal cancers	0.06	0.06	0.12	0.62	0.48	0.50
Noninvolved Workforce[d]						
Average worker dose (mrem/yr)[c]	24	24	24	24	24	24
50-year risk of fatal cancer	$4.8x10^{-4}$	$4.8x10^{-4}$	$4.8x10^{-4}$	$4.8x10^{-4}$	$4.8x10^{-4}$	$4.8x10^{-4}$
Total dose (person-rem/yr)	34	34	34	34	34	34
50-year fatal cancers	0.68	0.68	0.68	0.68	0.68	0.68
Total Site Workforce[e]						
Dose (person-rem/yr)	37	37	40	65	58	59
50-year fatal cancers	0.74	0.74	0.80	0.90	0.76	0.78

[a] Under the Upgrade Alternative (either without RFETS or LANL Pu or with RFETS pits), 25 in-plant workers badged with dosimeters to monitor radiation exposure would be required to operate the storage facility, with an estimated additional 25 badged in-plant workers needed if Pu (pit and non-pit material) is transferred from RFETS and LANL. The impacts given in the Upgrade Alternative (with RFETS and LANL Pu) include those associated with these additional workers. The number of involved badged workers for the two Consolidation Alternatives would be 123 and 92; for the Collocation Alternative the number of badged workers would be 95.

[b] The involved worker is a worker associated with operations of the proposed action. The maximum dose to an involved worker would be kept below 500 mrem per year. [Text deleted.] An effective ALARA program will ensure that the exposure will be reduced to that level which is as low as reasonably achievable.

[c] The radiological limit for an individual worker is 5,000 mrem/year (10 CFR 835). However, DOE has also established an administrative control level of 2,000 mrem per year (DOE 1992t); the site must make reasonable attempts to maintain worker doses below this level.

[d] The noninvolved worker is a worker onsite but not associated with operations of the proposed action. The projected number of noninvolved badged workers in 2005 is 1,400. The noninvolved workforce is equivalent to the No Action workforce.

[e] The impact to the total site workforce is the summation of the in-plant worker impact and the noninvolved worker impact. [Text deleted.]

Source: PX 1996e:2; PX DOE 1996a; and Section M.2.

to onsite workers and to the public in adjacent communities, contributions to the hazardous chemical concentrations from all other sources (for example, industrial operations) are considered negligible for purposes of risk calculations.

The HI to the MEI of the public at Pantex resulting from normal operation under the No Action Alternative is $5.7x10^{-3}$, and the cancer risk is $1.1x10^{-8}$. The HI to the onsite worker is $6.1x10^{-3}$, and the cancer risk is $4.5x10^{-7}$.

Facility Accidents. Under the No Action Alternative, Pu would continue to be stored at Pantex in existing facilities. These facilities currently operate in accordance with DOE safety orders which ensure that the risk to the public of prompt fatalities due to accidents or cancer fatalities due to operations will be minimized. The safety to workers and the public from accidents at existing facilities is also controlled by Technical Safety Requirements specified in detail in SARs or a Basis for Interim Operations document prepared and maintained specifically for a facility or process within a facility. Under these controls, any change in approved operations or to facilities would cause a halt in operations until it can be established that worker and public safety has not been compromised.

Table 4.2.4.9–3. Potential Hazardous Chemical Impacts to the Public and Workers During Normal Operation at Pantex Plant—No Action and Storage Alternatives

	No Action	Upgrade[a]		Consolidation		Collocation	
Receptor	Total Site[b]	Facility[c]	Total Site[b]	Facility[c]	Total Site[b]	Facility[c]	Total Site[b]
Maximally Exposed Individual (Public)							
Hazard index[d]	5.7×10^{-3}	0	5.7×10^{-3}	1.4×10^{-4}	5.8×10^{-3}	2.0×10^{-4}	5.9×10^{-3}
Cancer risk[e]	1.1×10^{-8}	0	1.1×10^{-8}	1.5×10^{-7}	1.6×10^{-7}	1.5×10^{-7}	1.6×10^{-7}
Worker Onsite							
Hazard index[f]	6.1×10^{-3}	0	6.1×10^{-3}	7.0×10^{-4}	6.8×10^{-3}	9.3×10^{-4}	7.1×10^{-3}
Cancer risk[g]	4.5×10^{-7}	0	4.5×10^{-7}	6.2×10^{-6}	6.7×10^{-6}	6.2×10^{-6}	6.7×10^{-6}

[a] Chemical impacts are the same for all three upgrade subalternatives.
[b] Total=Sum of the No Action plus the contributions of the above facility.
[c] Contribution from the above activity only (that is, the amount of increase over the existing No Action level at the site).
[d] Hazard index for MEI=Sum of the individual Hazard Quotients (noncancer health effects) for MEI.
[e] Cancer risk for MEI=(Emissions for 8-hour) x (0.286 [converts concentrations to doses]) x (slope factor [SF]).
[f] Hazard index for workers=Sum of individual Hazard Quotients (noncancer health effects) for workers.
[g] Cancer risk for workers=(Emissions for 8-hour) x (0.286 [converts concentrations to doses]) x (0.237 [fraction of year exposed]) x (0.571 [fraction of lifetime working]) x (SF).
Note: Where there are no known carcinogens among the hazardous chemicals emitted, there are no slope factors, therefore the calculated cancer risk value is 0.
Source: Section M.3; Tables M.3.4–14 through M.3.4–17.

Upgrade Alternative

Preferred Alternative: Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

This section describes the radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the modified existing Pu storage facilities under the Upgrade Alternative at Pantex. The section describes the impacts from normal facility operations at Pantex, then describes impacts from facility accidents.

During normal operation at Pantex, the operation of the Pu storage facilities under this alternative would result in impacts that are within applicable regulatory limits. Storage of RFETS pits would occur in Zone 4 until Zone 12 facilities are available for the Preferred Alternative. The radiological impacts for intersite transportation between Zone 4 and Zone 12, the repackaging from FL(B) into AL-R8 containers, and the storage in Zone 4 of pits from RFETS are described in Appendix Q.

[Text deleted.]

Normal Operation. There would be no radiological releases during the modification of existing storage facilities at Pantex. Construction worker exposures to materials potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of the construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct exposures. The resulting doses and potential health effects to the public and workers at Pantex are described below.

Radiological Impacts. The dose to the public would be reduced slightly from the No Action Alternative for the Upgrade With RFETS Pu Pits Subalternative, as shown in Table 4.2.4.9–1. The number of pits at Pantex to be

stored in upgraded facilities in Zone 12 South would be slightly increased by the addition of RFETS pits. However, before the material would be placed in facilities in Zone 12, pits would be repackaged from AL-R8 containers into AT-400A containers. The AT-400A has both an inner container (which is welded and prevents the release of any radioactive materials) and an outer container (which also prevents the release of radioactive materials and provides additional shielding material). The upgraded storage facilities in Zone 12 would have improved safety and design features over those in Zone 4, including filters to reduce the possibility of airborne releases to the atmosphere. Therefore, the overall effect of moving Pantex and RFETS pits into upgraded Zone 12 storage facilities would be lower potential releases of radioactive materials to the public.

Doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included in the table are involved workers directly associated with the storage facilities, workers who are not involved with these facilities, and the entire workforce at Pantex. All doses would fall within regulatory limits and administrative control levels. The total dose to the involved workforce would be 3 person-rem/year, and for 50 years of operation the fatal cancers would be 0.06.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the modified facilities under the Upgrade Alternative at Pantex are presented in Table 4.2.4.9–3. The impacts from all site operations, including the storage facilities, are included in this table. Total site impacts, which include the No Action impact plus the facilities, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public would be zero (because no hazardous substances would be released), and the cancer risk would be zero (because no carcinogens would be released) as a result of operation of the storage facilities under the Upgrade Alternative in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 5.7×10^{-3} and a cancer risk of 1.1×10^{-8} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be zero (because no hazardous substances would be released), and the cancer risk is zero (because no carcinogens would be released from the hazardous chemicals used) as a result of operation of the storage facilities in the year 2030. The HI and cancer risk would remain constant over 50 years of operation, because exposures are expected to remain the same. The total site operation, including the storage facilities, would result in an HI of 6.1×10^{-3} and a cancer risk of 4.5×10^{-7} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for the Upgrade With RFETS Pu Pits Subalternative facility for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–4. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.26 at Pantex for the beyond design basis earthquake accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 1.3×10^{-6}, 8.4×10^{-9}, and 2.3×10^{-8}, respectively. The maximum population 50-year facility lifetime risk would be 8.8×10^{-4} (that is, one fatality in about 57,000 years) at Pantex for the PCV penetration accident scenario with a probability of 0.04 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 5.8×10^{-6} and 1.4×10^{-5}, respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenario identified in Table 4.2.4.9–4.

Table 4.2.4.9–4. Upgrade With Rocky Flats Environmental Technology Site Plutonium Pits Subalternative—Accident Impacts at Pantex Plant

	Worker at 1,000 m		Maximum Offsite Individual		Population to 80 km		
Accident Description	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatality (per 50 yr)[a]	Probability of Cancer Fatality[b]	Risk of Cancer Fatalities (per 50 yr)[a]	Number of Cancer Fatalities[c]	Accident Frequency (per yr)
PCV puncture by forklift	5.3×10^{-8}	1.8×10^{-6}	2.1×10^{-8}	7.1×10^{-7}	3.2×10^{-6}	1.1×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	3.1×10^{-9}	1.8×10^{-7}	1.2×10^{-9}	7.1×10^{-8}	1.9×10^{-7}	1.1×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	1.4×10^{-5}	7.2×10^{-6}	5.8×10^{-6}	2.9×10^{-6}	8.8×10^{-4}	4.4×10^{-4}	0.04
Vault fire	1.2×10^{-8}	2.4×10^{-3}	4.7×10^{-9}	9.4×10^{-4}	7.2×10^{-7}	0.14	1.0×10^{-7}
Truck bay fire	1.2×10^{-9}	2.5×10^{-4}	4.9×10^{-10}	1.0×10^{-4}	7.6×10^{-8}	0.015	1.0×10^{-7}
Spontaneous combustion	1.2×10^{-11}	3.5×10^{-7}	4.9×10^{-12}	1.4×10^{-7}	7.6×10^{-10}	2.2×10^{-5}	7.0×10^{-7}
Explosion in the vault	1.8×10^{-9}	3.6×10^{-4}	7.2×10^{-10}	1.4×10^{-4}	1.1×10^{-7}	0.023	1.0×10^{-7}
Explosion outside of vault	1.3×10^{-11}	2.7×10^{-6}	5.3×10^{-12}	1.1×10^{-6}	8.2×10^{-10}	1.6×10^{-4}	1.0×10^{-7}
Nuclear criticality	9.7×10^{-12}	1.9×10^{-6}	4.6×10^{-12}	9.3×10^{-7}	1.2×10^{-10}	2.3×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	2.3×10^{-8}	4.7×10^{-3}	8.4×10^{-9}	1.7×10^{-3}	1.3×10^{-6}	0.26	1.0×10^{-7}
Expected risk[d]	1.4×10^{-5}	–	5.8×10^{-6}	–	8.8×10^{-4}	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

[b] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the impacts in Table 4.2.4.9–7 with adjustments to reflect smaller quantities of Pu for upgraded storage.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. Because the facilities will be modified, design information necessary to support a reasonable estimate of the accident impacts to the involved workers is not yet available. Such information would specify the locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details that affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Before modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Upgrade Without Rocky Flats Environmental Technology Site Plutonium or Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

During normal operation, there would be a slight reduction in radiological and hazardous chemical impacts from the Upgrade With RFETS Pits Subalternative if no RFETS or LANL Pu is moved to Pantex. The radiation impacts during normal operations to the public and workers are shown Tables 4.2.4.9–1 and 4.2.4.9–2, respectively. The doses to the public and workers for upgrade without RFETS Pu or LANL Pu is shown together

with the doses to the public and workers for upgrade with RFETS pits because this reduction in dose to the public and workers would not be measurable above background. The chemical impacts to the public and workers are shown in Table 4.2.4.9–3 and would not be detectable from the impacts for an upgrade facility with RFETS pits. For facility accidents, the impacts without RFETS Pu or LANL Pu would be slightly reduced from the impacts shown in Table 4.2.4.9–4 because of the smaller amount of Pu material. This reduction in potential impacts would not be detectable or measurable above background.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. Because the facilities will be modified, design information necessary to support a reasonable estimate of the accident impacts to the involved workers is not yet available. Such information would specify the locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details that affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Before modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Upgrade With All or Some Rocky Flats Environmental Technology Site Plutonium and Los Alamos National Laboratory Plutonium Subalternative

Modify Existing Zone 12 South Facilities for Continued Plutonium Storage

During normal operation, there would be a slight increase in radiological and hazardous chemical impacts from the Upgrade With RFETS Pits Subalternative if all of the RFETS and LANL Pu is moved to Pantex. The radiation impacts during normal operations to the public and workers are shown Tables 4.2.4.9–1 and 4.2.4.9–2, respectively. The doses to the public for upgrade with all the RFETS Pu and LANL Pu are shown together with the doses to the public and workers for upgrade with RFETS pits because the difference in the dose to the public would not be measurable above background. The doses to the workers with all the RFETS Pu and LANL Pu would be increased to 6 person-rem/year. The increase would be because the non-pit material would require additional handling not currently performed at Pantex. The chemical impacts to the public and workers are shown in Table 4.2.4.9–3 and would not be detectable from the impacts for an upgrade facility with RFETS pits. For facility accidents, the impacts with all RFETS Pu and LANL Pu would be increased above the impacts shown in Tables 4.2.4.9–5 and 4.2.4.9–6 because the non-pit material would require additional handling and operations not currently performed at Pantex.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. Because the facilities will be modified, design information necessary to support a reasonable estimate of the accident impacts to the involved workers is not yet available. Such information would specify the locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details that affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions and criticality could cause fatalities to workers close to the accident. Before modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

[Text deleted.]

Consolidation Alternative

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with new or modified consolidated Pu storage

facilities at Pantex. Normal operation under either of the two consolidated storage options would result in impacts that are within applicable regulatory limits.

[Text deleted.]

Construct New and Modify Existing Zone 12 South Facilities

Normal Operation. There would be no radiological releases from constructing a new storage facility or from modifying existing storage facilities to store the consolidated Pu. Construction worker exposures to material potentially contaminated with radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers at Pantex are described below for consolidated Pu storage in the modified storage facility.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new and modified Pu storage facilities at Pantex are presented in Table 4.2.4.9–1. The impacts from all site operations, including the storage facilities, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual operations of the new and modified storage facilities would be 9.5×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.4×10^{-10}. The impacts to the average member of the public would be less. As a result of operations in the year 2030, the population dose would be 5.5×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.4×10^{-6}.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5, and would be 6.5×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.6×10^{-9}. The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.3×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 8.4×10^{-6}.

Doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included are involved workers directly associated with the new and modified storage facilities, workers who are not involved with these facilities, and the entire workforce at Pantex. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Doses to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemicals associated with constructing new and modifying existing facilities for the consolidation of Pu will be equal to, or less than, hazardous chemicals associated with operations under the Collocation Alternative for Pu storage. The resulting hazardous chemical impacts to the public and worker will be equal to, or less than, those appearing in Table 4.2.4.9–3 for the collocation of Pu.

Facility Accidents. A set of potential accidents have been postulated for the upgrade of existing and construction of new storage facilities at Pantex for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft)

from the accident release point, the maximum offsite individual located at the site boundary, and the general population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–5 for the Surplus Materials Storage Building and in Table 4.2.4.9–6 for the Strategic Reserves Storage Building. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.29 at the Pantex Surplus Materials Storage Buildings for the vault fire accident scenario with a probability of $1x10^{-7}$ per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be $1.5x10^{-6}$, $1.1x10^{-8}$ and $2.9x10^{-8}$, respectively. The maximum population 50-year facility lifetime risk would be $1.8x10^{-3}$ (that is, one fatality in about 28,000 years) at the Pantex Surplus Material Storage Building for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be $1.3x10^{-5}$ and $3.2x10^{-5}$, respectively. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 1.8 at the Pantex Strategic Reserves Storage Building for the vault fire accident with a probability of $1x10^{-7}$ per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be $9.0x10^{-6}$, $7.6x10^{-8}$ and $2.2x10^{-7}$, respectively. The maximum population 50-year facility lifetime risk would be $1.8x10^{-3}$ at the Pantex Strategic Reserves Storage Building for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be $1.3x10^{-5}$ and $3.2x10^{-5}$, respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Tables 4.2.4.9–5 and 4.2.4.9–6.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Before construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Construct New Plutonium Storage Facility

Normal Operation. There would be no radiological releases during the construction of a new consolidated Pu storage facility at Pantex. Construction worker exposures to material potentially contaminated with radioactivity would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers at Pantex are described below for consolidated Pu storage in the new storage facility.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new consolidated Pu storage facility are presented in Table 4.2.4.9–1. The impacts from all site operations, including the new consolidated storage facility, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage plant operation would be $9.5x10^{-6}$ mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be $2.4x10^{-10}$. The impacts to the average member of the public would be less. As a result of storage plant operation in the year 2030, the population dose would be $5.2x10^{-5}$ person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be $1.3x10^{-6}$.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR 61, Subpart H) and DOE Order 5400.5 and would be 6.5×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.6×10^{-9}. The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.3×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 8.3×10^{-6}.

Facility and total site doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included are involved workers directly associated with the new consolidated storage facility, workers who are not involved with the new storage facility, and the entire workforce at Pantex. All doses fall within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of this facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidated Pu storage facility at Pantex are presented in Table 4.2.4.9–3. The impacts from all site operations, including the consolidated storage facility, are included in this table. Total site impacts, which include the No Action impact plus the facility, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 1.4×10^{-4}, and the cancer risk is 1.5×10^{-7} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the upgrade facility, would result in an HI of 5.8×10^{-3} and a cancer risk of 1.6×10^{-7} for the MEI in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 7.0×10^{-4}, and the cancer risk is 6.2×10^{-6} as a result of operation of the new consolidated Pu storage facility in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 6.8×10^{-3} and a cancer risk of 6.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for a new consolidated storage facility for which there may be releases of Pu that may impact onsite workers and the offsite population. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–7. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.41 at Pantex for the beyond design basis earthquake accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 2.1×10^{-6}, 1.4×10^{-8}, and 3.7×10^{-8} respectively. The maximum population 50-year facility lifetime risk would be 1.4×10^{-3} (that is, one fatality in about 36,000 years) at Pantex for the PCV penetration accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.2×10^{-6} and 2.3×10^{-5}, respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.4.9–7.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of

Table 4.2.4.9–7. Consolidation Alternative Accident Impacts at Pantex Plant

Accident Description	Worker at 1,000 m: Risk of Cancer Fatality (per 50 yr)[a]	Worker at 1,000 m: Probability of Cancer Fatality[b]	Maximum Offsite Individual: Risk of Cancer Fatality (per 50 yr)[a]	Maximum Offsite Individual: Probability of Cancer Fatality[b]	Population to 80 km: Risk of Cancer Fatalities (per 50 yr)[a]	Population to 80 km: Number of Cancer Fatalities[c]	Accident Frequency (per yr)
PCV puncture by forklift	5.3×10^{-8}	1.8×10^{-6}	2.1×10^{-8}	7.1×10^{-7}	3.2×10^{-6}	1.1×10^{-4}	6.0×10^{-4}
PCV breach by firearms discharge	3.1×10^{-9}	1.8×10^{-7}	1.2×10^{-9}	7.1×10^{-8}	1.9×10^{-7}	1.1×10^{-5}	3.5×10^{-4}
PCV penetration by corrosion	2.3×10^{-5}	7.2×10^{-6}	9.2×10^{-6}	2.9×10^{-6}	1.4×10^{-3}	4.4×10^{-4}	0.064
Vault fire	1.9×10^{-8}	3.8×10^{-3}	7.5×10^{-9}	1.5×10^{-3}	1.1×10^{-6}	0.23	1.0×10^{-7}
Truck bay fire	1.2×10^{-9}	2.5×10^{-4}	4.9×10^{-10}	1.0×10^{-4}	7.6×10^{-8}	0.015	1.0×10^{-7}
Spontaneous combustion	1.2×10^{-11}	3.5×10^{-7}	4.9×10^{-12}	1.4×10^{-7}	7.6×10^{-10}	2.2×10^{-5}	7.0×10^{-7}
Explosion in the vault	2.9×10^{-9}	5.8×10^{-4}	1.2×10^{-9}	2.3×10^{-4}	1.8×10^{-7}	0.036	1.0×10^{-7}
Explosion outside of vault	1.3×10^{-11}	2.7×10^{-6}	5.3×10^{-12}	1.1×10^{-6}	8.2×10^{-10}	1.6×10^{-4}	1.0×10^{-7}
Nuclear criticality	9.7×10^{-12}	1.9×10^{-6}	4.6×10^{-12}	9.3×10^{-7}	1.2×10^{-10}	2.3×10^{-5}	1.0×10^{-7}
Beyond evaluation basis earthquake	3.7×10^{-8}	7.5×10^{-3}	1.4×10^{-8}	2.7×10^{-3}	2.1×10^{-6}	0.41	1.0×10^{-7}
Expected risk[d]	2.3×10^{-5}	–	9.3×10^{-6}	–	1.4×10^{-3}	–	–

[a] The risk values are calculated by multiplying the probability of cancer fatality (for the worker at 1,000 m or the maximum offsite individual or the number of cancer fatalities (for the population to 80 km) by the accident frequency and the number of years of operation.

[b] Increased likelihood (or probability) of cancer fatality to a hypothetical individual (a single onsite worker at a distance of 1,000 m or the site boundary, whichever is smaller or to a hypothetical individual in the offsite population located at the site boundary) if exposed to the indicated dose. The value assumes the accident has occurred.

[c] Estimated number of cancer fatalities in the entire offsite population out to a distance of 80 km if exposed to the indicated dose. The value assumes the accident has occurred.

[d] Expected risk is the sum of the risks over the 50-year lifetime of the facility.

Note: All values are mean values.

Source: Calculated using the source terms in Tables M.5.2.1.1–5 and M.5.2.1.1–6 and the MACCS computer code.

worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Before construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Collocation Alternative

Construct New Plutonium and Highly Enriched Uranium Storage Facilities

This section includes a description of radiological and hazardous chemical releases and their associated impacts resulting from either normal operation or accidents involved with the consolidation of Pu storage and collocation with HEU storage facilities at Pantex. This storage would take place in a new Pu and HEU storage facility.

Normal operation of the new collocated storage facility at Pantex would result in emissions that are within applicable regulatory limits.

[Text deleted.]

Normal Operation. There would be no radiological releases during the construction of a new collocated storage facility at Pantex. Construction worker exposures to material potentially contaminated with

radioactivity (for example, from construction activities involved with existing contaminated soil) would be limited to assure that doses are maintained ALARA. Toward this end, construction workers would be monitored, as appropriate. Limited hazardous chemical releases are anticipated as a result of construction activities. However, concentrations would be within the regulated exposure limits. During normal operation, there would be both radiological and hazardous chemical releases to the environment and also direct in-plant exposures. The resulting doses and potential health effects to the public and workers are described below.

Radiological Impacts. Radiological impacts to the public resulting from the normal operation of the new collocated storage facility at Pantex are presented in Table 4.2.4.9–1. The impacts from all site operations, including the new storage plant, are also given in the table. To put operational doses into perspective, comparisons with doses from natural background radiation are included in the table.

The dose to the MEI from annual storage facility operation would be 9.6×10^{-6} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 2.4×10^{-10}. The impacts to the average member of the public would be less. As a result of storage facility operation in the year 2030, the population dose would be 5.3×10^{-5} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 1.3×10^{-6}.

The dose to the MEI from annual total site operations is within the radiological limits specified in NESHAPS (40 CFR Part 61, Subpart H) and DOE Order 5400.5, and would be 6.5×10^{-5} mrem. From 50 years of operation, the corresponding risk of fatal cancer to this individual would be 1.6×10^{-9}. The impacts to the average member of the public would be less. This activity would be included in a program to ensure that doses to the public are ALARA. As a result of total site operation in the year 2030, the population dose would be within the limit in proposed 10 CFR 834 and would be 3.3×10^{-4} person-rem. The corresponding number of fatal cancers in this population from 50 years of operation would be 8.3×10^{-6}.

Doses to onsite workers from normal operations are given in Table 4.2.4.9–2. Included are involved workers directly associated with the new storage facility, workers who are not involved with the new storage facility, and the entire workforce at Pantex. All doses are within regulatory limits and administrative control levels. The associated risks and numbers of fatal cancers among the different workers from 50 years of operation are included in the table. Dose to individual workers would be kept low by instituting badged monitoring and ALARA programs and also workers rotations. As a result of the implementation of these mitigation measures, the actual number of fatal cancers calculated would be lower for the operation of the facility.

Hazardous Chemical Impacts. Hazardous chemical impacts to the public and to the onsite worker resulting from the normal operations of the new consolidation of Pu and collocation with HEU storage facilities at Pantex are presented in Table 4.2.4.9–3. The impacts from all site operations, including the consolidation of Pu and collocation with HEU storage facilities, are also included in this table. Total site impacts which include the No Action impact plus the facility impacts, are provided. All analyses to support the values presented in this table are provided in Section M.3.

The HI to the MEI of the public is 2.0×10^{-4} and the cancer risk is 1.5×10^{-7} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in an HI of 5.9×10^{-3} and a cancer risk of 1.6×10^{-7} for the onsite worker in the year 2030 and would be expected to remain constant as a result of 50 years of operation.

The HI to the onsite worker would be 9.3×10^{-4}, and the cancer risk is 6.2×10^{-6} as a result of operation of the new consolidation of Pu and collocation with HEU storage facilities in the year 2030. The HI and cancer risk from hazardous chemicals would remain constant over 50 years of operation, because exposures would be expected to remain the same. The total site operation, including the new facility, would result in a HI of 7.1×10^{-3},

and a cancer risk of 6.7×10^{-6} for the onsite worker in the year 2030. This would be expected to remain constant as a result of 50 years of operation.

Facility Accidents. A set of potential accidents have been postulated for collocation of Pu and HEU for which there may be releases of Pu or HEU that may impact onsite workers and the offsite population. The consequences and risks of potential accidents that release both Pu and HEU would be bounded by the impacts associated with Pu. The accident consequences and risks to a worker located 1,000 m (3,280 ft) from the accident release point, the maximum offsite individual located at the site boundary, and the population located within 80 km (50 mi) of the accident release point are summarized in Table 4.2.4.9–8. For the set of accidents analyzed, the maximum number of cancer fatalities in the population within 80 km (50 mi) would be 0.41 at Pantex for the beyond design basis earthquake accident scenario with a probability of 1.0×10^{-7} per year. The corresponding 50-year facility lifetime risk from the same accident scenario for the population, maximum offsite individual, and worker at 1,000 m (3,280 ft), would be 2.1×10^{-6}, 1.4×10^{-8}, and 3.7×10^{-8}, respectively. The maximum population 50-year facility lifetime risk would be 1.4×10^{-3} (that is, one fatality in about 36,000 years) at Pantex for the PCV penetration by corrosion accident scenario with a probability of 0.064 per year. The corresponding maximum offsite individual and worker 50-year facility lifetime risks would be 9.2×10^{-6} and 2.3×10^{-5}, respectively. Section M.5 presents additional facility accident data and summary descriptions of the accident scenarios identified in Table 4.2.4.9–8.

Involved workers, those that would work in the facilities associated with the proposed action, may be subject to injury and, in some cases, fatality as a result of potential accidents. The locations of workstations, number of workers, personnel protective features, engineered safety features, and other design details affect the extent of worker exposures to accidents. Certain accidents such as fires, explosions, and criticality could cause fatalities to workers close to the accident. Before construction of a new or modification of an existing facility, DOE Orders require detailed safety analyses to assure that facility designs and operating procedures limit the number of workers in hazardous areas and minimize risk of injury or fatality in the event of an accident.

Subalternative Not Including Strategic Reserve and Weapons Research and Development Materials

If the strategic reserve and weapons R&D materials are not included, the impacts to the pubic and to workers from the accident-free storage activities would be reduced in proportion to the decrease in the amount of material stored. The impacts from total site operations would decrease slightly. This subalternative applies to the No Action Alternative, the Upgrade Alternative, the Consolidation Alternative, and the Collocation Alternative. The risks due to accidents would also tend to be lower.

Phaseout

Normal Operation. A phaseout of existing Pu storage facilities at Pantex would reduce the impacts from radiological and chemical releases and exposures to levels slightly below the No Action levels. All workers involved in the transfer of the Pu from existing storage would be monitored to assure that their doses remain within regulatory limits and as low as reasonably achievable.

Facility Accidents. The phaseout operation will be conducted in accordance with DOE Orders to ensure that the risk to the public of prompt fatalities due to accidents or of cancer fatalities due to operations will be minimized. For current operations in the facility that would be phased out, the safety of workers and the public from accidents is controlled by Technical Safety Requirements that are specified in SARs or Basis for Interim Operations documents that have been prepared for the facility. Prior to initiating phaseout, the potential for accidents that could impact workers and the public will be assessed and, if necessary, applicable existing safety documentation will be modified to ensure safety for workers and the public.